

Membrane System for Recovery of Volatile Organic Compounds from Remediation Off-Gases

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Abstract

In situ vacuum extraction, air or steam sparging, and vitrification are widely used methods of remediating soil contaminated with volatile organic compounds (VOCs). All of these processes produce a VOC-laden air stream from which the VOCs must be removed before the air can be discharged or recycled to the generating process. Treatment of these off-gases is often a major portion of the cost of the remediation project. Carbon adsorption and catalytic incineration, the most common methods of treating these gas streams, suffer from significant drawbacks.

Membrane Technology and Research, Inc. (MTR) proposes an alternative treatment technology based on permselective membranes that separate the organic compounds from the gas stream, producing a VOC-free air stream. The technology we propose to develop can be applied to off-gases produced by various remediation activities. The system will be skid-mounted and automatic for easy transportation and unattended operation. The system will remove the VOCs as a concentrated liquid phase, will produce clean air (less than 10 ppmv VOC) for discharge or recycling, and will produce dischargeable water (less than 1 ppmw VOC).

We have completed the first phase of a two-phase project. The Phase I laboratory experiments were designed to demonstrate the feasibility of the proposed approach. In the subsequent Phase II, a demonstration system is to be built and operated at two field sites. The work performed in Phase I showed that:

- (1) Membrane modules containing feed-side baffles have better VOC/air separation properties than conventional modules.
- (2) Hollow fiber contactors are very efficient stripping devices for the removal of VOCs from water.

- (3) The novel system developed is capable of reducing the VOC concentration in remediation off-gas to 10 ppmv, while producing a concentrated VOC phase and dischargeable water containing less than 1 ppmw VOC.
- (4) The membrane system is competitive with carbon adsorption if the VOC concentration in the remediation off-gas is 100 ppmv or higher.

A design was prepared for a demonstration system to treat 100 scfm off-gas, and the McClellan Air Force Base near Sacramento, California, has agreed to participate in the first field test. The base is host to the National Environmental Technology Test Site, and has several test beds available with access to soil vacuum extraction off-gases. The field demonstration system is under construction and testing at McClellan Air Force Base will start early in 1998.

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